		Local mean time.				Sun's altitude.	
		h.	m.	s.		°	′
First external contact,	Dec. 6	8	52	37	a.m.	30	15
,, internal ,,	,,	9	13	23	a.m.	33	54
Last internal ,,	,,	2	39	5	p.m.	32	17
,, external ,,	,,	3	0	22	p.m.	28	29

WELLS' COMET.—The following places of this comet are for Greenwich midnight :—

	R.A.			Decl.		Log. distance from	
	h.	m.	s.	°		Earth.	Sun.
July 27	11	39	1	+5	58·7	0·2614	0·1380
29	11	44	41	5	38·3	·2732	·1506
31	11	50	5	5	18·5	·2867	·1626
August 2	11	55	14	4	59·3	·3004	·1742
4	12	0	9	4	40·6	·3126	·1853
6	12	4	51	4	22·7	·3244	·1960
8	12	9	22	4	5·2	·3358	·2064
10	12	13	43	3	48·2	·3469	·2164
12	12	17	54	3	31·7	·3576	·2260
14	12	21	56	+3	15·7	0·3680	0·2354

The calculated intensity of light on August 9 is equivalent to that at the first Harvard College observation on March 19.

COMET-SEEKING IN THE SOUTHERN HEMISPHERE.—From a communication to the *Sydney Morning Herald*, we learn that Mr. Tebbutt, of Windsor, N.S.W., the discoverer of the great comet of 1861, has, at the instance of the Boston (U.S.) Scientific Society, undertaken the organisation of a corps of amateur comet-seekers in Australia, and with this object has addressed a circular to several persons in the colonies, who have manifested an interest in the science. We wish Mr. Tebbutt every success: the matter could not be in better hands. It would be easy to adduce numerous cases where the theories of these bodies have suffered from the want of southern observations, and it may be hoped, that in conjunction with the systematic search undertaken by a number of observers in America, and, we are glad to add, in this country also, it will be quite an exceptional case for a comet within range of ordinary telescopes to escape detection, as we know many have done in past years. The additions to the number of comets of short period during the last fifteen years, are alone a sufficient inducement to institute more systematic examination of the heavens in future.

PHYSICAL NOTES

AN organ-pipe sonometer is described in the *American Journal of Science*, by Mr. Le Conte Stevens. The ordinary resonance box of the sonometer is in this instance replaced by a double organ-pipe of spruce fir-wood, tuned to give the note $C=132$ vibrations. Three steel wires are stretched above, two being tuned to the fundamental, the other strained to various degrees of tension by a lever and a sliding weight. There are also arrangements for sharpening or flattening the note of one of the pipes at will, so as to produce beats. By varying the wind-pressure, the natural harmonics of the pipes can be produced. The object of the instrument is to afford a convenient means of producing the notes of the natural scale and those of the tempered scale, by way of contrasting them with one another. The apparatus has several other uses as a lecture instrument in acoustics.

M. CAILLETET has invented a new pump for compressing gases to a high degree of compression. The main point in its construction is the method by which he obviates the existence of useless space between the end of the piston-plunger and the valve, which closes the end of the cylinder. This he accomplishes by inverting the cylinder and covering the end of the plunger with a considerable quantity of mercury. This liquid piston can of course adapt itself to all the inequalities of form of the interior space, and sweeps up every portion of the gas, and presses it up a conical passage into the valve. The valve by which the air enters the body of the pump is opened by a cam-gearing after the descent of the piston below point where the air rushes in.

ANOTHER suggestion due to M. Cailletet is worthy of notice, and is applicable to many pieces of laboratory apparatus beside air-pumps. It is the employment of *vaseline* as a lubricant wherever there is a liability of the presence of mercury; for, as is known, most oils and fatty matters clog with finely-divided mercury, and are objectionable on this account.

NEW forms of secondary battery continue to make their appearance, most of them based upon the accumulator of Planté. Mr. R. E. Crompton has lately patented a process for giving a large effective surface to the leaden electrodes by making it porous, by adding to the lead some other substance capable of being extracted by the action of acid, or by heat, or by other reagents. Another modification due to Messrs. Biggs and Beaumont, consists in collecting in a separate vessel the hydrogen or other products of decomposition, in the accumulator, the collected products being afterwards recombined as fast as required. The electrodes in this case are composed of finely divided lead.

WE have also received a report of a lecture delivered by M. Maurice Lévy before the Societé d'Encouragement on the same subject of electrical units. It speaks volumes for the mathematical education given in the public schools of Paris, if an audience of a society comparable to that of our Society of Arts could follow the lecturer through a mathematical discussion like that before us, which includes a discussion of the doctrine of dimensional equations, and of the elimination of arbitrary coefficients. M. Lévy applauds the decisions of the Congress, which he expounds logically and elegantly.

THE following experiment of Messrs. Jamin and Maneuvrier illustrates the presence of an inverse electromotive force in the voltaic arc, dependent on the actions therein excited by the current. A continuous current was passed first from coke to mercury, producing a reddish coloured arc. The current was then reversed, when the arc appeared green, and the metal volatilised rapidly. Then the current of an alternating Gramme machine was passed through the same arrangement. The arc now appeared green, showing a predominance of the current from mercury to coke, although in ordinary circumstances the two alternately directed currents are absolutely equal in strength.

THE decisions of the Electrical Congress have aroused the electricians of several Continental nations to realise the advance in exact science which the adoption of a uniform system of electrical units implies; and not to be behindhand, they are striving to spread a knowledge of what has been done. The new determination which is to be made of the value of the ohm has furnished material for several discussions, in which it is curious to observe the suggestions that were brought forward as new. Others content themselves with expounding that which has been already done. We have before us, from the pen of Dr. Guglielmo Mengarini, assistant in the Physical Institute of the University of Rome, a "History of the Electromagnetic Unit of Resistance," reprinted from the official bulletin of the Minister of Public Instruction. Beginning with the work of Davy, Becquerel, Ohm, and Wheatstone, the author describes how gradually the rheostat brought forth the resistance-coil, and the units of Siemens and of the British Association. He then gives a theoretical discussion of the absolute electromagnetic unit of resistance, and an account of the methods of Weber and of the British Association for determining it. The main points in the propositions submitted to the International Congress at Paris in 1881 are then given, together with the formal decisions of the Congress thereupon.

A VALUABLE contribution to the subject of the electricity of flame has been lately made by Herren Elster and Geitel (*Wied. Ann.* No. 6). The discrepancies in previous results are attributed largely to the behaviour of the air layer immediately outside of the flame having been left out of account. The authors used a Thomson quadrant electrometer for measurement. They find the supposed longitudinal polarisation of flame merely apparent, and due to unequal insertion of the wires used as electrodes. On the other hand, flame is strongly polarised in cross section; an electrode in the air about the flame is always positive to one in the flame. The theory the authors adopt is this:—By the process of combustion *per se* free electricity is not produced in the flame; but the flame-gases and the air-envelope have the property of exciting, like an electrolyte, metals or liquids in contact with them. To this electrolytic excitation is added a thermo-electric, due to the incandescent state of the electrodes. The amount and nature of the electric excitation is independent of the size of the flame, and dependent on the nature, surface-condition, and glow of the electrodes, and on the nature of the burning gases. *Inter alia*, it is remarked that flames may be combined in series like galvanic elements, and so as to form a "flame-battery."

IN a recent dissertation (*Wied. Ann.* No. 7), Herr Heine describes experiments on the absorption of heat by gas-mixtures with varying percentage of constituents, and he thence deduces a method of ascertaining the amount of carbonic acid in the air. Varied mixtures of CO_2 and air, in known proportions, were

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formed in a tube to which the heat of a Bunsen burner was admitted (through a rock-salt plate); and the resultant variations of pressure were recorded by means of a Knoll pantograph. The curve obtained (with percentages as abscissæ and indicated pressures recorded as ordinates) shows, as one might expect, a decrease of rise of pressure through absorption of heat, with decrease of CO_2, but the two are not proportional. With regular decrease of CO_2 from 100 per cent., the fall is slight, in the curve, to about 5 per cent., and thereafter rapid to zero with pure air. (Mixtures of CO_2 and H gave a different curve, with a much lower position throughout.) By chemical methods the CO_2 has been shown to vary between 0·02 and 0·05 per cent. Hence it was desirable to develop the corresponding part of the curve just described with special care. This was done, and atmospheric air, freed from moisture, but not from CO_2, was admitted to the apparatus. The tabulated results of fifty analyses made thus, in four days, at Giessen, appear to prove the applicability of the method. (The proportion of CO_2 varied between 0·020 and 0·034.) Its advantages are: only small quantities of air (one or two litres) being required, and the operations being quite simple, and taking little time (say half an hour). It is suggested that the aqueous vapour in air may be similarly measured.

A THIRD instalment of researches on transpiration of vapours, by Herr Steudel, at the instance of Prof. Lothar Meyer, is described in *Wied. Ann.* No. 7; it relates to alcohols and their halogen derivatives, and to some substitution-products of ethane and methane. In a concluding paper Prof. Meyer reviews the inquiry. The supposition is confirmed, that homologous series, even with very different molecular weight, have for the most part nearly the same constants of friction. (All compounds containing one carbon atom show strong divergence.) The influence of the nature of the contained atoms, on friction, is remarkable. Thus, with about equal molecular weight, iodine produces a much greater friction than bromine, and the latter a greater than chlorine. Far-reaching conclusions as to the form of molecules, Prof. Meyer is not prepared to draw, but the cross section of the molecule of a tertiary butylic compound is inferred to be less than that of the corresponding secondary, and the latter less than that of the primary. This agrees with received views as to the linking of these compounds. The molecular volumes reckoned from the friction of vapours, stand to each other in nearly the same ratios as the molecular volumes in the liquid state at boiling point.

FROM observations made several years ago, Prof. von Reusch of Tübingen was led to think the hydrophane of Czernowitza a substance peculiarly well fitted for diffusion experiments with gases. Its properties in this relation have now been carefully studied by Herr Hufner (*Wied. Ann.* No. 6); and *inter alia*, it is shown that the resistance to passage of a number of gases is related both to the coefficients of absorption and the specific gravities; all three increasing in the same sense (but not in simple proportion).

AN interesting analogy to thermoelectric phenomena, &c., is given by M. Bouty in the *Journal de Physique* (June). Suppose a tubular ring, impermeable to heat, containing in its lower half sand saturated with water, and in its upper air saturated with water-vapour. If heat be applied at one end (A) of the sand, a circulation is set up, the water being vaporised at A, condensed at the opposite end B, and filtering through the sand to replace the water evaporated at A. Again, suppose (instead of heat) a rotary pump acting about the middle of the air space; a circulation is produced, and the water evaporating at A causes a fall of temperature, while the condensation at B causes a rise; an image is thus presented of Peltier's phenomenon. The junction A, which is cooled, is precisely the one which must be heated to produce the existing circulation, and the quantity of heat absorbed at A is proportional to the weight of water evaporated per second, that is, to the intensity of the current.

SIGNOR MARTINI (*N. Cim.* [3] 9, 1881) obtains diffusion figures thus: A glass vessel is filled with two liquids little differing in density, *e.g.* water and an aqueous solution of salt or sugar. They are left at rest for an hour. A capillary tube entering the bottom of the vessel is connected by caoutchouc tubing with a movable vessel of coloured alcohol. When the latter enters by the capillary, it rises as a thin spiral thread, but on reaching the lighter liquid it spreads into fine tree-shaped figures. Figures of umbrella shape are produced, if the heavier liquid be used in place of the alcohol.

PROF. T. C. MENDENHALL, of Columbus, Ohio, communicates to the *American Journal of Science* a paper on the Influence of Time on the Change of Resistance of the Carbon Disk of Edison's Tasimeter. This resistance was found, when pressure was removed suddenly, to return to its maximum value; but when pressure was applied, time was necessary to enable the resistance to reach its minimum. On applying pressure, the resistance fell a little more than 3 per cent. in one minute, about 5 per cent. in three minutes, and about 10 per cent. in one and a half hours.

CONTRARY to the opinion now generally received concerning the alleged change of resistance of carbon under pressure, Mr. Mendenhall, in the communication alluded to in the preceding note, asserts that the effect is not due to better surface contact. His own experiments were made with one of Edison's compressed lampblack buttons resting in its place in the tasimeter, and covered by an "upper contact piece." This is all the information given upon this vital point of how the contacts were made, and in the absence of any evidence of care or precautions to ascertain whether the contact was perfect or not, the opinion pronounced must be regarded as worth very little.

GEOGRAPHICAL NOTES

THE *Journal* of the Straits Branch of the Bengal Asiatic Society for December, 1881, contains a short comparative vocabulary of the Fijian and Maori (New Zealand) languages, with notes by Mr. Thurston and Sir F. A. Wild. The Maori is a recognised member of the Eastern Polynesian linguistic family, and from these specimens the Fijian might be supposed to belong to the same connection. But the natives, especially of the eastern islands of the Fiji Archipelago, have long been exposed to Polynesian influences, through their relations with the Tonga islanders. These influences are apparent both in their physical type and in the numerous dialects current on the coast. But the skulls of the Kai Colos occupying the interior of Viti Levu have been shown by Prof. Flower to be of a distinctly Papuan character. In fact, they are the most dolichocephalic on the globe. The outward appearance of the Kai Colos and other tribes removed from contact with the Tonga people also closely resembles that of the pure Melanesians of the New Hebrides and Solomon groups. Specimens of their speech have not yet been collected; but it may be taken for granted that it will be found to be of a distinctly Melanesian type, betraying little or no affinity to the Polynesian. Such vocabularies as these, while possessing a certain value, are apt to be very misleading, and have in fact contributed to the current belief that the Polynesian and Melanesian tongues are fundamentally one. In reality they possess nothing in common beyond the verbal resemblances due to the wide-spread Polynesian influences in the Melanesian domain. In their morphology and inner structure, the two systems are radically distinct.

HIRT, of Breslau, has published a second part of the "Geographische Bildertafeln," by Dr. Oppel and Herr Arnold Ludwig, the first part of which we noticed recently. This part is devoted to typical landscapes, and the selection seems to us to have been made with great discrimination. For Great Britain, for example, we have Loch Ness in Scotland, a Scotch Moor, the Giants' Causeway, the Dover Coast, a Welsh Valley, and an extensive landscape on the Upper Thames. All the other leading countries of Europe are treated after a similar fashion, while representative scenes are given from the great divisions of the other continents. The interest and utility of such a collection are obvious. The same publisher issues also a coloured panorama, showing the chief forms of the land and water on the surface of the globe, much superior to the publications of the same class with which we are familiar in this country.

LIEUT. GIRAUD has sailed from Marseilles for Zanzibar, as leader of a French expedition which proposes to take up African exploration where Livingstone laid it down with his life on the south shore of Lake Bangweolo. Lieut. Giraud proposes to go either direct west to Lake Tanganyika, or, more probably, by the north shore of Lake Nyassa, to the Chambeze River. This he will follow to its outlet in Lake Bangweolo, which he proposes to circumnavigate. He will then attempt, in canoes, to sail down the Luababa-Congo, to its mouth in the Atlantic Ocean. This is an ambitious programme; and every one interested in African exploration will wish the expedition complete success.

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